

## **Part 1**

# **Linear Modeling**

LM1.tex

**Exercise 1** A landscaping company charges \$45 per cubic yard of mulch plus a delivery charge of \$20.

- (a) A linear function which computes the total cost  $C$  (in dollars) to deliver  $x$  cubic yards of mulch is given by  $y = \boxed{45x + 20}$ .
  - (b) According to the linear function above, 20 cubic yards of mulch costs \$ $\boxed{920}$ .
  - (c) According to the linear function above, \$560 will buy you  $\boxed{12}$  cubic yards of mulch.
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LM2.tex

**Exercise 2** Water freezes at  $0^\circ$  Celsius and  $32^\circ$  Fahrenheit and it boils at  $100^\circ$  C and  $212^\circ$  F.

Write your answers as improper fractions if necessary.

- (a) A linear function  $F$  that expresses temperature in the Fahrenheit scale in terms of degrees Celsius (which we represent by the variable  $x$ ) is  $F(x) = \boxed{(9/5)x + 32}$ .
  - (b) Using the above function,  $20^\circ$  C is  $\boxed{68}^\circ$  Fahrenheit.
  - (c) A linear function  $C$  that expresses temperature in the Celsius scale in terms of degrees Fahrenheit (which we represent by the variable  $x$ ) is  $C(x) = \boxed{(5/9)x - 160/9}$ .
  - (d) Using the above function,  $110^\circ$  F is  $\boxed{130/3}^\circ$  Celsius.
  - (e) The temperature  $x$  at which  $F(x) = C(x)$  is  $\boxed{-40}^\circ$ .
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LM3.tex

**Exercise 3** Your friend buys a new car, and as soon as they drive it off the lot, it begins to depreciate in value. After 2 years, the car is worth \$16,000 and after 4 years, the car is worth \$12,000. Assume that the car's value drops linearly.

- (a) A linear function  $V$  that expresses the value of the car in terms of the number of years  $x$  since it was purchased is  $V(x) = \boxed{-2000x + 20000}$ .
- (b) The  $y$ -intercept of the function  $V$  is  $(\boxed{0}, \boxed{20000})$ .
- (c) The  $y$  value of the  $y$ -intercept represents

**Multiple Choice:**

- (i) the starting value of the car. ✓
- (ii) the time at which the car's value is 0.
- (iii) the average value of the car over its lifespan.
- (d) The  $x$ -intercept of the function  $V$  is  $(\boxed{40}, \boxed{0})$ .
- (e) The  $x$  value of the  $x$ -intercept represents

**Multiple Choice:**

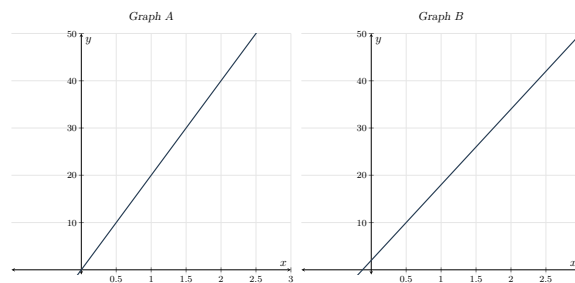
- (i) the starting value of the car.
- (ii) the time at which the car's value is 0. ✓
- (iii) the average value of the car over its lifespan.

LM4.tex

**Exercise 4** You and your friend decide to have a bike race. Your speed is 16 kilometers per hour, and your friend's is 20 kilometers per hour. Your friend is faster than you are, so they give you a head start of 2 kilometers.

Let  $f(x)$  be a linear function expressing the distance (in kilometers) you travel, and  $g(x)$  be a linear function expressing the distance (in kilometers) your friend travels.

- (a) One of the following graphs represents  $f(x)$  and the other represents  $g(x)$ .



The graph representing  $f(x)$  is

**Multiple Choice:**

- (i) Graph A.
  - (ii) Graph B. ✓
- (b) A linear equation for the distance you travel is  $f(x) = \boxed{16x + 2}$ .
- (c) A linear equation for the distance your friend travels is  $g(x) = \boxed{20x}$ .
- (d) If the race is 5 kilometers long, who will win?

**Multiple Choice:**

- (i) You ✓
  - (ii) Your friend
  - (iii) It will be a tie
- (e) If the race is 10 kilometers long, who will win?

**Multiple Choice:**

- (i) You
  - (ii) Your friend
  - (iii) It will be a tie ✓
- (f) If the race is 20 kilometers long, who will win?

**Multiple Choice:**

- (i) You
- (ii) Your friend ✓
- (iii) It will be a tie

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**Exercise 5** A salesperson is paid \$200 per week plus 5% commission on her weekly sales of  $x$  dollars.

- (a) A linear function that represents her total weekly pay,  $W$  (in dollars) in terms of  $x$  is  $W(x) = \boxed{.05x + 200}$ .
- (b) In order for her to earn \$475 for the week, her weekly sales must be \$  $\boxed{5500}$ .
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